BULLETIN 310 1964

Dry Field Beans for Minnesota

UNIVERSITY OF MINNESOTA
Agricultural Extension Service
U. S. DEPARTMENT OF AGRICULTURE

Dry Field Beans for Minnesota

R. G. Robinson

DRY FIELD BEANS (*Phaseolus vulgaris*) are legumes harvested as mature dry beans. They are used for human food and reach the grocer's shelf in either canned or dry form. Nutritionally, beans are often considered "poor man's meat" because of their low cost and high protein content (over 20 percent) compared to grains and potatoes. In contrast to soybeans, field beans are low in oil.

Because beans are used for food, high quality is necessary. So production is usually located near a specialized bean cleaning plant.

Acreage of field beans in the United States is fairly stable at nearly 1½ million acres. Acreage and price of some classes may vary considerably with supply and demand, but government support prices exert a stabilizing influence.

Production in Minnesota

Many types and varieties of field beans can be grown in Minnesota. However, in the past 25 years, production as a commercial farm crop was chiefly navy beans in the 1940's and pinto since 1960.

During and shortly after World War II several thousand acres of navy beans were grown in Washington, Isanti, Anoka, Sherburne, and adjacent counties north of the Twin Cities. Cambridge was a major marketing center. Most production was on sandy soil and yields were generally low. When improved early maturing soybean varieties became available, farmers found them more profitable and navy bean acreage dwindled.

A processing plant was then established at Crookston so that navy bean production might be transferred to northwestern Minnesota. But bean acreage did not expand sufficiently so the Minnesota Bean and Pea Company now purchases beans from out-of-state.

Pinto bean production was started in 1961 by Max Campbell of Oslo. The Valley Bean Association at Oslo (Marshall County) is the major local market. Acreage is increasing and approached 10,000 in 1963. Another pinto bean plant is being planned at Borup.

R. G. Robinson is an associate professor, Department of Agronomy and Plant Genetics.

The information herein is supplied with the understanding that no discrimination is intended and no endorsement is implied.

Pinto is now probably the best type bean for Minnesota. There is opportunity for expansion since over ¼ million acres are grown in the United States, and Minnesota growers have low priced land, no irrigation costs, and have avoided hand hoeing costs by skilled cultivation practices. But high humidity and rainfall, as compared to the traditional bean-producing areas in western states, make quality bean production more difficult in Minnesota.

Although field beans are well adapted in southern and central Minnesota, present price relationships and marketing problems make soybeans more profitable. Production cost per acre and risk of a poor quality, unmarketable crop are greater for beans than for soybeans. Therefore, field bean production tends to be located north of the area where soybeans yield well.

In normal years experienced growers on good land should average 1,500 pounds of pinto beans per acre. Price to the grower has been about 5 cents per pound. Bean production fits in well with sugar beet production since row width, planting, and cultivation equipment are similar for both crops.

Growing Field Beans

The following information applies specifically to pinto beans and generally to other types since all field beans have similar requirements.

Crop Sequence—Beans perform well following most field crops, and most field crops do well following beans. Planting beans after small grains, corn, or forage crops is probably best. Do not plant beans on the same field oftener than once every 3 or 4 years.

Beans are usually off the field by early September in time to plant rye or winter wheat. Some sugar beet growers follow a rotation of wheat-fallow-sugar beets-pinto beans. If necessary, plant a barley cover crop in the fall on pinto ground to prevent soil blowing.

In Michigan and the Rocky Mountain states, beans following sugar beets are often poor. So some growers plant late to avoid root rots, some use manure to stimulate growth, and others plant beans before beets in the rotation but hoe beans for weed control. Slow growth of beans after beets has not been noticed in Minnesota.

On potato farms, beans generally follow potatoes or small grain.

Volunteer sunflowers make hand weeding necessary if beans follow sunflowers. At Rosemount, beans have grown well after soybeans but this practice may increase bacterial blight disease.

Beans are a good crop for planting between rows of widely spaced young tree plantings.

Soils and Fertilizers—Dry beans grow on most farm soils. Drainage

is of utmost importance because standing water injures beans in a few hours. Beans grow best in sandy loam to clay loam soils of high organic matter content. On these soils it is generally profitable to apply fertilizer to other crops in the rotation. On sandy soils, beans may respond profitably to fertilizer.

Little fertilizer is used on beans in Minnesota and the western states. In Michigan, an old bean-producing area, 150 to 200 pounds per acre of a complete fertilizer (nitrogen, phosphorus, and potassium) are commonly used.

Liming of acid soils is generally not necessary for beans.

Source of Seed—Certified seed from the low rainfall-low humidity western states is most likely to be of good quality and free of bacterial blights and anthracnose diseases. Seed treatments do not control these diseases. To avoid spread of these diseases from home-grown seed, buy certified seed from blight-free western areas each year. Idaho Certified Pinto No. 111 seed is recommended.

Seed Treatment and Inoculation—Treat seed with a fungicide to control disease organisms carried on the outside of the seed and soil-borne seed-rotting organisms. Thiram (Arasan, Panoram, Thiram) or captan (Orthocide, Captan) is most commonly used.

You can use insecticides such as aldrin, dieldrin, heptachlor, or lindane as seed treatments to protect germinating seeds from seed-corn maggot and some other soil insects.

Inoculation of legume seed to supply bacteria for nitrogen fixation is a good practice. However, many pinto bean growers feel it is unnecessary. Seed treatment is more important. Inoculate treated seed at time of planting.

Time of Planting—Beans are susceptible to frost and do not germinate in cold soil. Therefore, plant 2 or 3 weeks after normal corn planting time. At St. Paul, plantings on June 5 produced as high yields as plantings made during the last half of May. Plantings on June 15 yielded less than those made in late May.

Consult weather records and choose a planting date so that beans will mature when dry weather can be expected. Beans have to dry in the windrow for several days. Rain during this period can seriously damage bean quality.

Some northern Minnesota growers plant pinto beans during the last 10 days in May; this allows harvest to be completed in late August or early September. May planting may be too early in cold springs so consult weather forecasts.

Trials reported in the table (page 9) were planted during the 1st week in June. Refer to the "date harvested" column to calculate the approximate time required to mature each variety.

Planting—You can plant beans with sugar beet planters, corn planters, or grain drills and can use a wide range of row spacings. Sugar beet growers use 20 to 24 inches. In some other bean-producing states, 28-inch rows are common. You can use rows 40 inches apart but this results in lower yields.

A minimum planting rate for Pinto 111 is 60 pounds per acre. This assumes use of treated seed of 95 percent or more germination and an excellent seedbed. In 22-inch rows this is a seed spacing of 4 inches apart in the row. Three-inch spacing requires 75 to 80 pounds per acre. The optimum seed spacing is 3 to 4 inches apart in 22-inch rows.

Uniformity of final stand is the important factor since a plant spacing of 6 inches will produce a full yield. Use 60 to 75 pounds of seed per acre for wider row spacing, even though seeds are closer together in the row. In extremely wide row spacings—40 inches—reduce rate to 50 to 60 pounds per acre. If germination is below 95 percent, increase planting rates in order to keep the viable seed spacing indicated above.

For other varieties of beans refer to the column headed "number of seeds per pound" in the table. If they have fewer seeds per pound than Pinto 111, increase planting rate proportionately; if more, decrease planting rate. For erect nonvining varieties like Sanilac, a slightly closer seed spacing—2½ to 3 inches—is optimum.

Shallow planting—1 to 1½ inches—is generally best if seed is in moist soil. Deeper planting may sometimes be necessary to reach moisture. Soil temperatures average higher at the 1 than at the 3-inch depth so deep planting may seriously delay emergence.

Cultivation—Cultivate to control weeds and to hill up rows to facilitate operation of the puller at harvest.

Before emergence, bean fields can be spike-tooth harrowed to kill emerging weeds. After beans emerge, use such implements as the weeder, rotary hoe, spike-tooth harrow, or wire-tooth harrow to kill weeds. Because the basis of selectivity is differential size, only small emerging weeds "in the white" stage can be uprooted and killed without injury to larger beans. It may pay to harrow the field several different times before the first cultivation if weed emergence warrants it.

Beans are generally cultivated twice; soil is thrown into the row to cover weeds and hill up the rows. Hilling-up also promotes growth of adventitious roots to replace the primary root if affected by root rot.

To avoid spreading bacterial blights, do not cultivate, harrow, or even enter bean fields when foliage is moist.

In major bean-producing states, fields are hoed once by migratory labor. Minnesota growers usually avoid this expense.

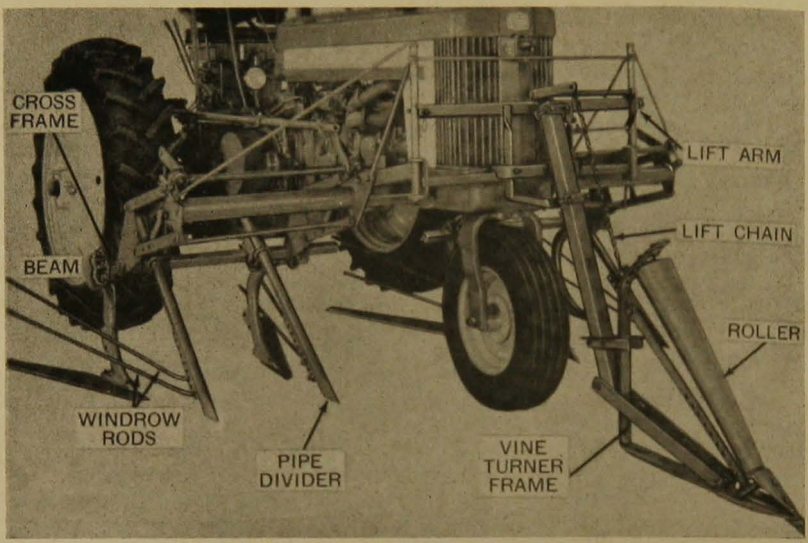

Figure 1. Blades on this four-row bean puller throw two rows between the rear tractor wheels and one to the outside of each wheel. This arrangement is commonly used for wide row spacings. In 20- to 28-inch rows, it is best to throw all four rows between the rear tractor wheels.

Picture courtesy of John Deere Company.

Harvesting—Pull beans before frost when most pods are yellow and most seed mature. At this time some green pods and a few leaves will be present (top cover photograph). Nearly mature beans continue to ripen after they are pulled. Immature small or lightweight seed can be removed in threshing. Frozen immature seed is difficult to separate.

Four-row, six-row, or two-row bean pullers are mounted behind the front wheels of a tractor (see figure 1). Each blade, which resembles a plowshare about 3½ feet long, pulls one row. The blade is set at an angle and cuts under the hilled-up bean row about 1½ inches deep. A row separator, consisting of a pipe with windrow rods, is positioned directly in front of each blade point. The beans are pulled out; windrow rods above the blades put two field rows into a cutter row.

When vine growth is heavy, you may have to use a vertical roller attachment in front of the tractor wheels to separate rows. These rollers have also been used over blade shanks to prevent plugging.

A windrower operating behind the puller elevates the beans, removes some stones and soil, and delivers the pulled beans into a windrow. If you use a four-row puller, the windrow from the next four

rows is placed alongside the first windrow. So an eight-row windrow is left to dry. Instead of a windrower, you can use a side delivery rake.

On small acreages you can harvest good quality beans by hand pulling or with a two-row puller. Use a side delivery rake to make windrows. If wet weather threatens, you can stack beans around posts in the field.

Make bean stacks around a steel or wood fencepost driven firmly into the ground. Place a 1-foot layer of straw around the post so the diameter is at least 3 feet. Build the bean stack around the post to a height 2 feet above the top of the post. Sides can be 6 inches wider at the top than at the bottom. A snow fence form 3½ feet in diameter will aid in making stacks. About 12 stacks per acre are needed. Stacking requires 3 man-hours of hard labor per acre.

Combining—Beans are usually ready to combine from the windrow in 4 to 10 days. Some growers *start* combining when beans are about 16-percent moisture. Safe moisture levels for storage are 14½ percent for short-time and 12½ percent for long-time storage. The seeds are easily broken so carefully adjust cylinder speed and concave clearance. Cylinder speed is usually about 250 to 400 r.p.m. Cylinder-concave bar clearance should allow beans to pass through without injury. Split beans sell for a low price; cleaning plants sell splits to feed mills and livestock feeders.

Pests

Diseases—Minnesota pinto growers fortunately have escaped serious losses from bean diseases. Use of certified, Idaho-grown, treated seed and crop rotation are basic controls.

Bacterial blights (common blight, halo blight, bacterial wilt, and fuscous blight) and anthracnose fungus disease are encouraged by damp weather. Rain drop splashing, animals, and farm machinery spread the diseases from plant to plant.

The blight bacteria and anthracnose fungi can overwinter on dead plant material for 2 years. So do not plant beans on a field more than once in 3 or 4 years. Use of fungicide sprays to control anthracnose is seldom practical.

Mosaic diseases and curly top are caused by viruses. Mosaics are spread by aphids, curly top by beet leafhoppers. Curly top and yellow mosaic are not seed-borne but common mosaic may be. Pinto 111 is resistant to curly top and some strains of mosaic.

White mold or *Sclerotinia* wilt, rust, and root rots may cause losses. Crop rotation helps control these diseases. Never spread manure from livestock fed bean straw or cull beans on land to be planted to beans.

Sunscald lesions on pods and leaves may be mistaken for bacterial blight. Sunscald normally occurs when beans approach maturity and is usually not serious.

Baldhead seedlings with no growing tips result from thresher-damaged seed or from insect or rabbit feeding.

Insects—Insecticide sprays and dusts (DDT, methoxychlor, malathion, sevin, Kelthane) will help control insects on beans. Minnesota growers have not yet had to use insecticides on the crop. If you use insecticides, always follow limitations and waiting periods listed on the label. Most seed is insecticide-treated for seed-corn maggot control.

Weeds—Most growers have not used herbicides. If harrowing and cultivating do not give adequate weed control, hand hoe and consider using herbicides.

Herbicides available for use on beans include EPTC (Eptam) and DNBP amine salt (Premerge, Sinox PE).

Apply EPTC before planting at a rate of 3 pounds per acre and, within minutes, disk it into the soil. EPTC kills many grass and non-grass annual weeds. It is sometimes effective on wild oats but not on wild mustard. EPTC generally gives more lasting control than DNBP. Occasionally EPTC has injured navy beans.

Apply DNBP amine salt when beans are emerging (*not later than crook stage*) at a rate of 3 to 4½ pounds per acre. This is primarily a contact killer for small and germinating weeds. For preemergence application at planting time, use 9 pounds.

Follow label directions and use herbicides on a *small area* the 1st year to observe performance on your soil type. Other herbicides appear promising but do not yet have label approval by the Pesticides Regulation Division, U. S. Department of Agriculture.

Types or Commercial Classes of Field Beans

(See figure 2 and the table)

Navy, also known as the pea bean, is the most important type. Most production is in Michigan and is used in canned pork and beans. Navy is also sold as a dry bean for boiling or baking.

Navy beans are well adapted in Minnesota but any white bean is difficult to harvest completely free of dark or diseased-appearing seeds. Firms can no longer afford to pick out off-colored seeds by hand. Electric eye machinery sorts beans in major bean-producing areas, but is not now available for bean sorting in Minnesota.

Recommended varieties are Michelite and Sanilac. The new varieties Seaway and Gratiot are lower yielding. Michelite 62 and Saginaw are promising new varieties. Michelite, Michelite 62, and Saginaw are

Field bean variety comparison at Rosemount*

Variety	Years of trial	Date harvested	Number of seeds per pound	Yield per acre (pounds)
Navy				
Michelite	1960-63	September 15	2,234	2,523
Sanilac	1960-63	September 1	2,548	2,005
Gratiot	1962-63	September 3	2,375	1,704
Seaway	1960-62	August 25	2,622	1,637
Pinto				
Idaho No. 111	1960-63	September 2	1,140	2,447
Idaho No. 113	1960-63	August 25	1,128	2,431
Columbia	1960-61	August 30	1,143	2,306
Scout	1963	September 2	1,379	2,030
San Juan Select	1963	September 28	1,169	1,743
Luna	1963	October 23	1,166	3,385
Great Northern				
Idaho No. 31	1960-63	September 4	1,194	2,272
Idaho No. 123	1960-61	September 4	1,296	2,260
USDA No. 1140	1960-62	August 26	1,350	2,219
Nebraska No. 1	1961	September 6	1,184	2,176
Kidney				
Red	1960-61	September 6	915	1,301
White	1960-61	September 7	913	1,466
Small White				
Idaho No. 74	1962-63	September 9	2,426	1,786
Small Red				
Red Mexican Idaho No. 34	1960-62	September 11	1,271	2,811
Red Mexican Idaho No. 35	1960-61	September 11	1,143	2,594
Yelloweye				
Yelloweye	1960-63	September 11	1,060	1,292
Steuben	1962-63	September 5	1,055	1,619
Kenearly	1962-63	September 3	1,022	921
White Marrow				
Perry	1960, 1962	September 8	874	1,245
Lapin (white)	1961-63	September 7	1,751	2,402
Berna (brown)	1961-63	September 9	1,065	1,768
Adzuki	1962-63	September 25	3,086	1,840
Tepary	1963	September 14	2,984	1,260
Mung-Morden 39	1963	September 28	7,200	1,244

* Data of varieties not grown in all years adjusted by Patterson method to be comparable with other varieties.

vine types so some pods contact the soil. Sanilac, Seaway, and Gratiot are upright bush types and few pods rest on the soil (see figure 3).

Pinto is second to navy beans in acreage and production. Most production is in the Rocky Mountain states, principally Colorado, Idaho, and Wyoming. Pinto beans are sold as dry beans for boiling

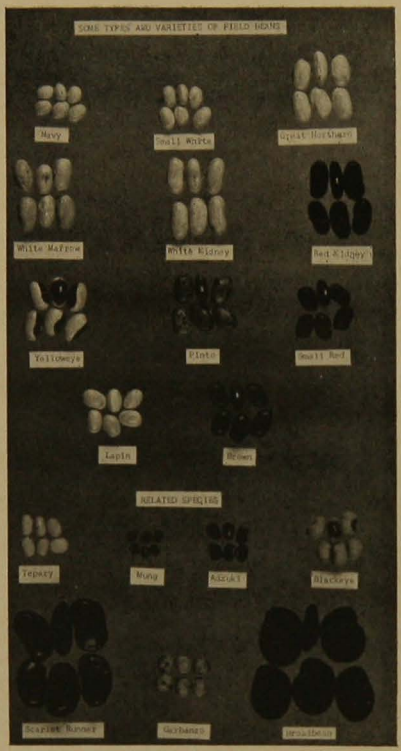

Figure 2. Dry bean seeds.

or baking and as canned beans. The crop is well adapted and can be economically produced in Minnesota.

Idaho No. 111 is an excellent variety; ample supplies of certified and registered seed are available in Idaho. Idaho No. 113 has also performed well in Minnesota trials. Other varieties tested include Scout, Columbia, San Juan Select, and Luna. Luna produces the largest vine growth and is a tremendous yielder but is too late for a normal Minnesota season. All pinto varieties are vine types and many pods contact the soil.

Great Northern, a large white bean, is third in U. S. production. Nebraska leads in acreage, followed by Idaho and Wyoming. Great Northern competes with navy beans for the dry package trade. Navy is preferred for the canning trade because it holds its shape when cooked.

Great Northern yields well but it is difficult to obtain good quality without sorting machinery. The viny growth habit permits many pods to contact the soil, so pods and seeds may discolor.

Idaho No. 31 has been a consistently high yielder followed closely by No. 123 and USDA No. 1140. Great Northern 1140 is outstanding in earliness. Nebraska No. 1 tended to produce a poorer quality bean with more hard seed.

Kidney is widely used in canning. New York leads in production, followed by Michigan and California.

Kidney is upright in growth and holds its pods completely off the soil. It is susceptible to all common bean diseases. Varieties include Charlevoix, Dark Red Kidney, Light Red Kidney, and White Kidney.

Small White and Flat Small White are mainly produced in California. Little of the acreage is flat small white. The small whites are used for baking and are canned in pork and beans. The seed resembles navy but the foliage is a different shade.

Idaho No. 74 has been inferior to recommended varieties of navy

Figure 3.
Left: vine type beans.

Right: bush type beans.

beans. It is a medium-sized plant of viny growth habit and the pod tips contact the soil.

Small Red and Pink classes are each produced in about the same quantity as the small white class. California and Washington lead in production. These beans compete in the market with other colored beans such as pinto and cranberry. Many are exported to Caribbean Islands and Latin America.

The small red varieties are usually called Red Mexican. They have a viny growth habit and many pods rest on the soil. Red Mexican varieties Idaho No. 34 and No. 35 are high yielding beans. Whether Minnesota can produce satisfactory quality to compete with western-grown Red Mexican for the limited market is doubtful.

Yelloweye is a large white bean with a yellow spot around the hilum (eye) of the bean. It has excellent baking quality. Michigan and New York lead in production.

Steuben is the best variety. Kenearly is early but a low yielder. These varieties hold most pods off the soil.

White Marrow is grown on a small acreage in New York. Perry Marrow variety holds its pods off the soil; seeds are white and extremely large.

Cranberry is grown on a small acreage in Michigan; **Black Turtle Soup** class is grown in New York.

Other Species of Dry, Edible Beans

The following are also sometimes called field beans:

Mung (*Phaseolus aureus*) is used for bean sprouts. Oklahoma leads in production. Oklahoma common green and Morden 39 varieties were found to be indeterminate and retained their leaves until frost. Although satisfactory for gardens, available varieties probably are not commercially profitable in Minnesota.

Blackeye (*Vigna sinensis*), the popular blackeye pea or southern pea, is actually a bean. Yield was low at Rosemount—about 300 pounds per acre.

Lima (*Phaseolus lunatus*) is grown almost exclusively in California. Production in Minnesota is as a green canning or freezing bean—not as a dry bean.

Tepary (*Phaseolus acutifolius*) is a small white bean of small forage growth. Although edible, it is rarely used.

Adzuki (*Phaseolus angularis*), a small red bean, is important in Japan. It grows erect like a soybean but many pods are close to the ground. The plant is indeterminate and holds its leaves until frost. Yields have been high at Rosemount.

Horsebean (*Vicia faba*), also called broadbean, grows erect like a soybean but is more closely related to peas. Horsebeans are like peas in climatic requirements and may have potential in Minnesota for feed grain and forage.

Garbanzo (*Cicer arietinum*), also called chickpea, is more closely related to peas than to beans. Yields and quality have been poor at Rosemount.

Scarlet Runner (*Phaseolus coccineus*) is sometimes used as an ornamental vine in Minnesota. Its hypocotyl does not elongate so it grows like a pea (see figure 4).

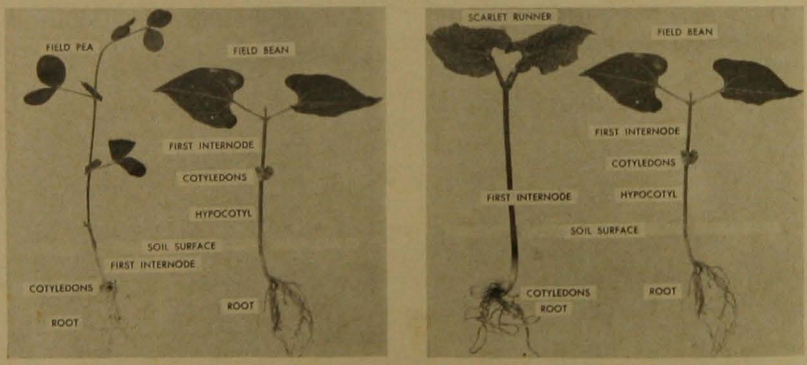

Figure 4. All types and varieties of field beans emerge by hypocotyl elongation. Horsebeans, garbanzo, and scarlet runner beans emerge like peas without hypocotyl elongation so cotyledons remain below ground. Cotyledons are attached to the stem at the first node.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. Roland Abraham, Acting Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55101. 6M—1-64